

Windows 2000[®] Storage Management Overview

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Presentation Objective

- **Why Storage is Important**
- **Windows 2000 Storage Architecture**
- **LDM and RSM**
- **HSM**
- **Brief File System Overview**
- **Indexing Services**
- **Backup**
- **Defrag**

Balanced System Design

The challenge is I/O

CPU Multiprocessing
Clustering

Memory

Speed
Density/\$

I/O
???

“Traditionally, faster CPUs were the order of the day.

In the future, balanced architectures with improved I/O performance, faster disk access and more efficient read/write capability will be mandatory” -

Gartner Group

“The Internet and Enterprise Intranets: The Impact on Distributed Computing” 7/96

Storage management

The management cost problem

Year	1985	1990	1995	2000
Storage per location	50 GB	1,000 GB	30,000 GB	1,000,000 GB
Hard disk storage cost	\$200/MB	\$12.5/MB	\$0.40/MB	\$0.01/MB

Cost to store \$10 million \$12.5 million \$12 million

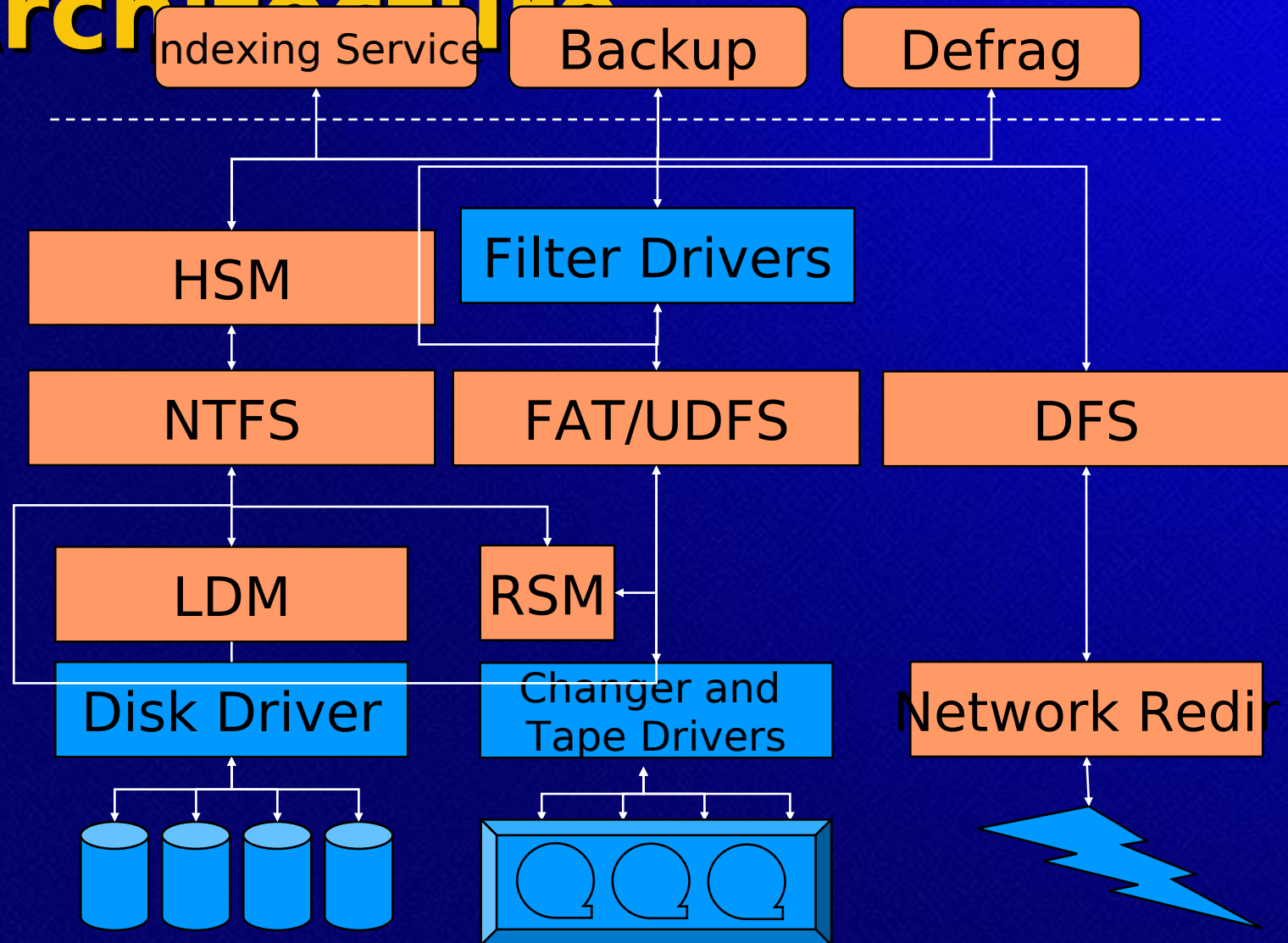
◆ **Online storage for the Fortune 1000**

◆ **While storage hardware costs are dropping dramatically, the management costs are not keeping step.**

Cost to manage at \$1/MB \$50,000 \$1 million \$30 million

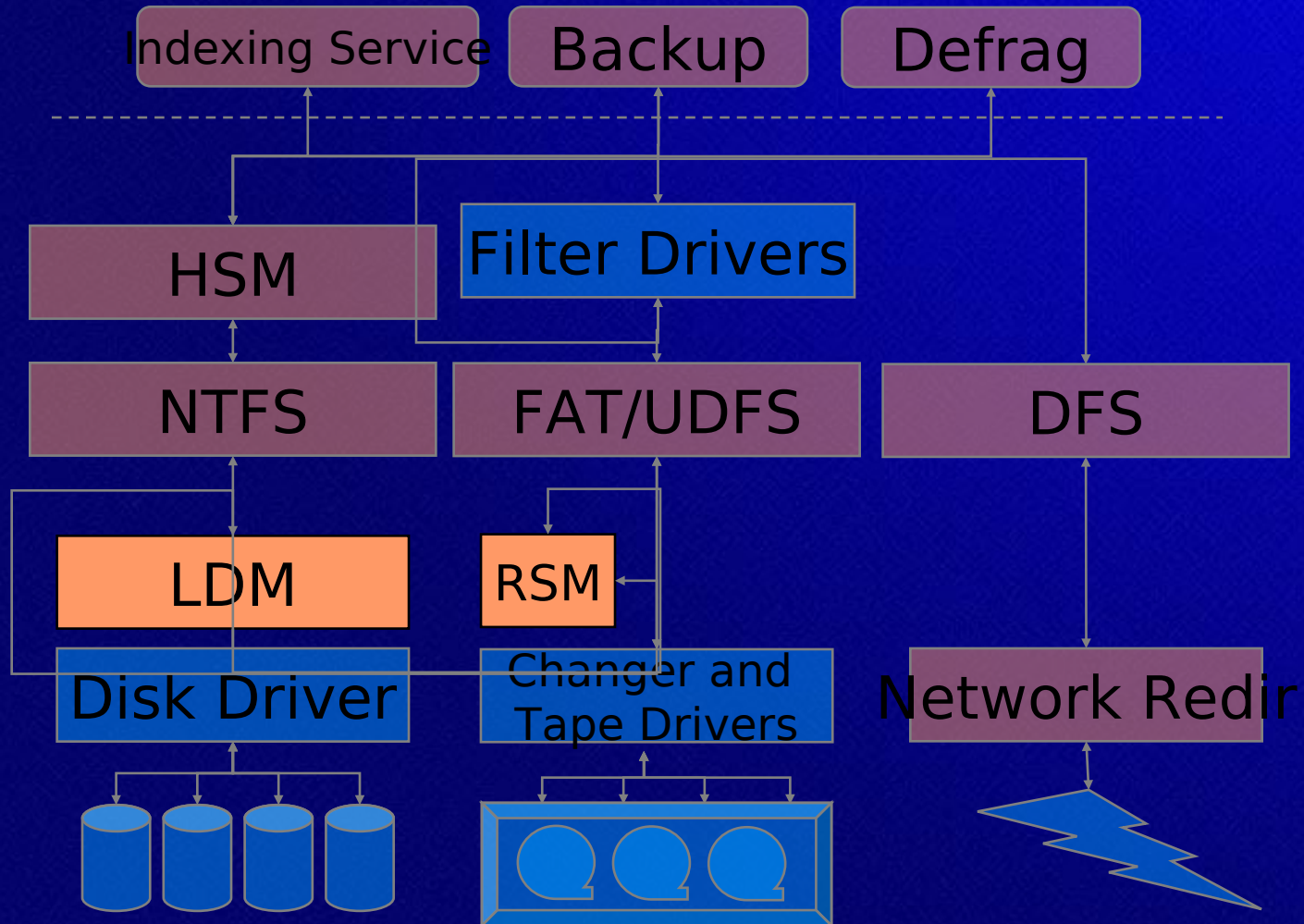
- ◆ Strategic Research estimates storage management cost at \$3/MB in 1998, down from \$8/MB in 1994.
- ◆ Automated storage management is an absolute requirement

General Storage Architecture



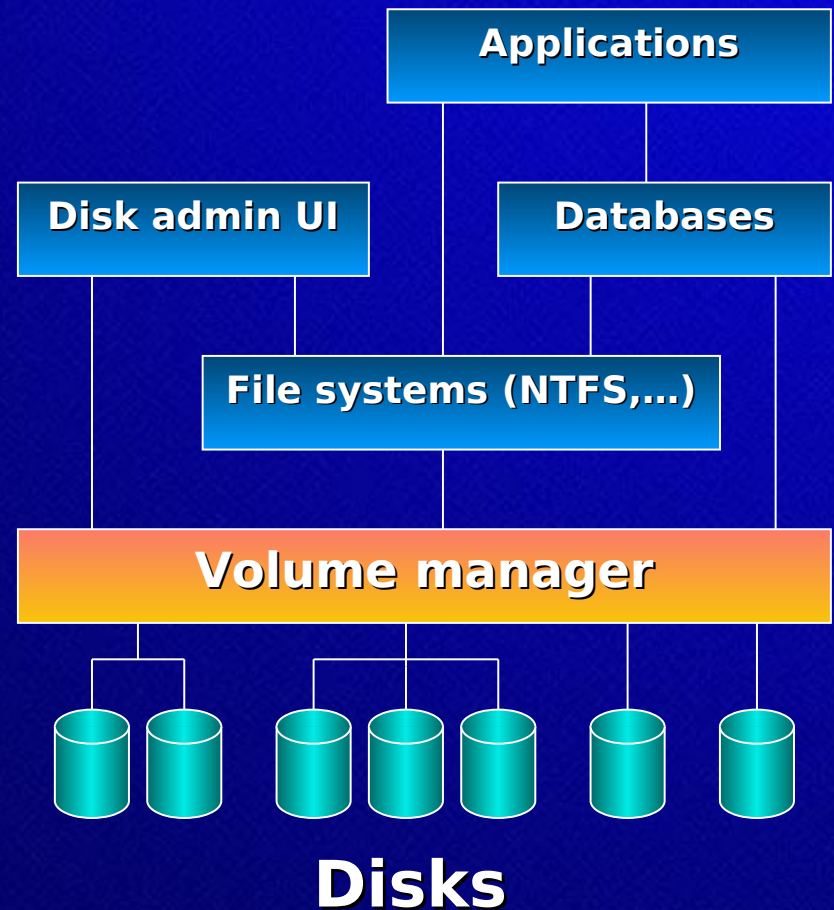
Storage Architecture

Storage Managers



Logical Disk Manager (LDM)

- ◆ Provided by Veritas
- ◆ Sits below file system. Implemented as a driver
- ◆ Same RAID levels as NT 4.0, but with better on-line manageability
- ◆ Seamless to applications and file systems



Logical Disk Manager

- ◆ **(LDM) Grow NTFS volumes without taking the volume offline.**
- ◆ **Create, break and recover NTFS-formatted stripes and mirrors without taking the volume offline.**
- ◆ **Force dismount even with open files - FAT and NTFS**
- ◆ **Mount volumes to directories (NTFS only)**
- ◆ **No limit on the number of volumes in a system**

Logical Disk Manager

(LDM)

Two kinds of disks now

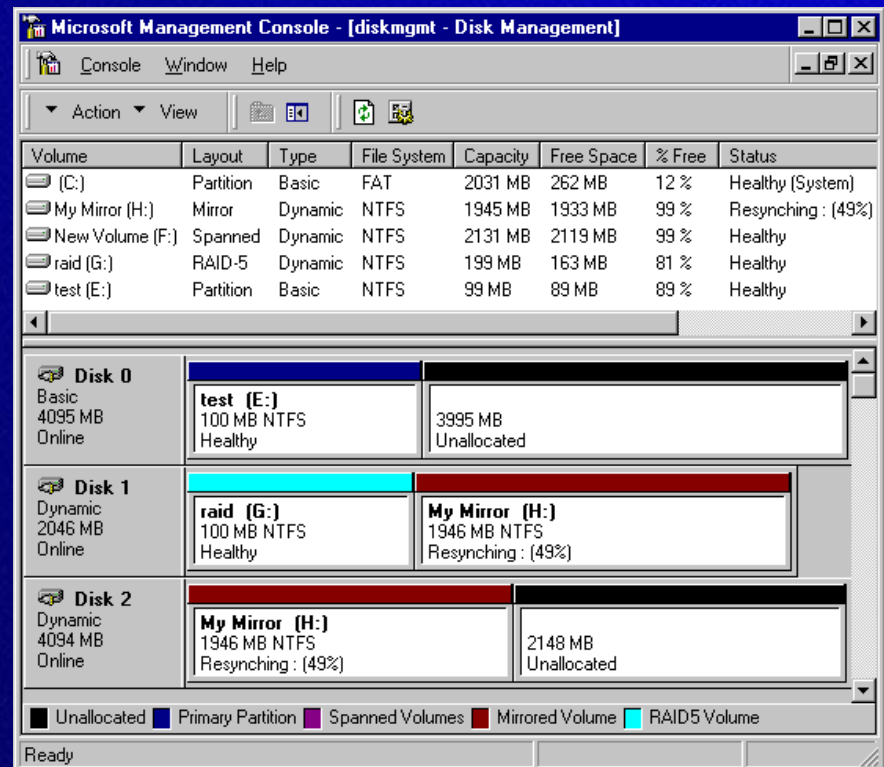
- **Basic disks (managed by ftdisk)**
 - Cannot be extended online
 - Existing RAID volumes can be used and repaired only
- **Dynamic disks (managed by new LVM)**
 - Can be extended online.
 - Dynamic disks are self-identifying - eases reconfiguration and recovery

Logical Disk Manager

(LDM) Management Console (MMC) snap-in

Volumes/File
Systems
(including mount
points)

Logical Disks



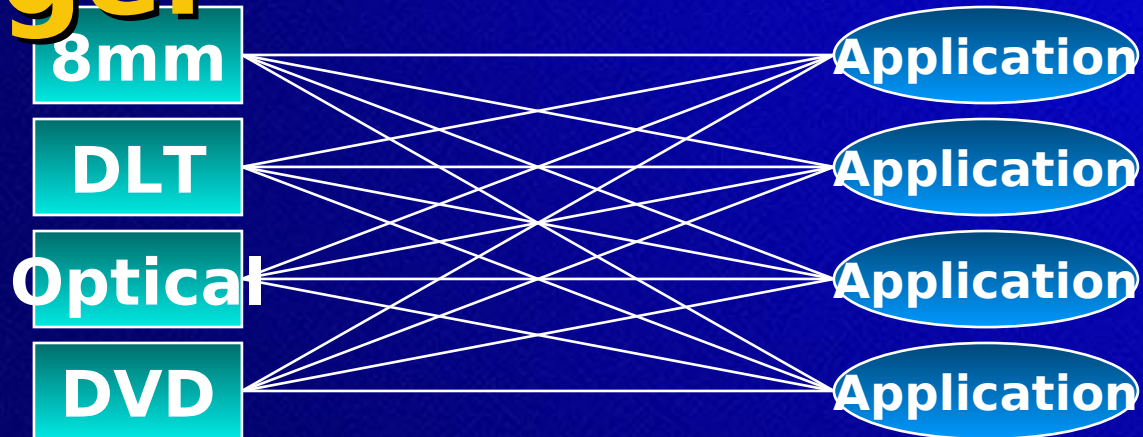
Removable Storage Manager

(RSM)

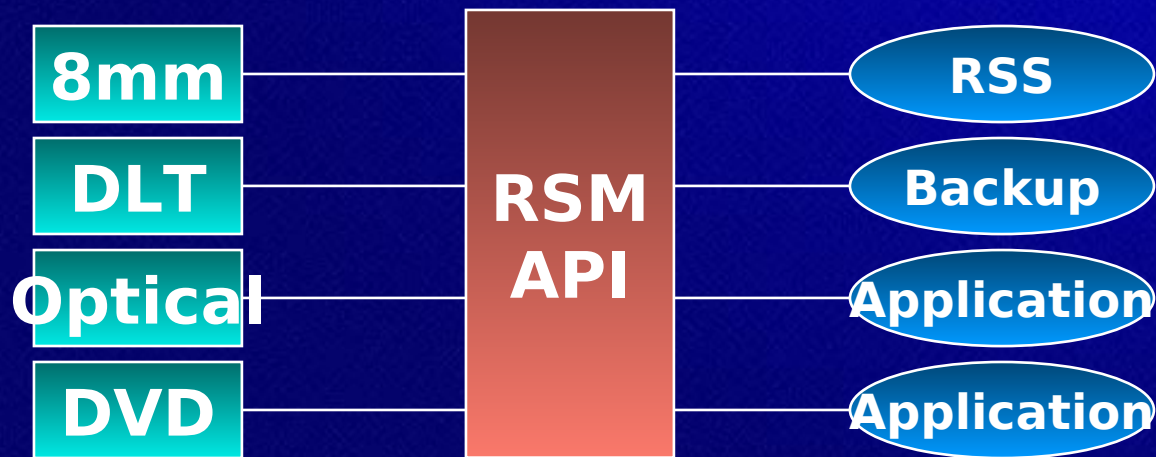
- ◆ Common device model
 - Broad support for changers
- ◆ Abstraction for developers
 - Allocate, deallocate
 - Mount, dismount
 - Move, eject, inject
 - Pool Management (free, application specific)

Removable Storage Manager

(RSM)
Before
RSM

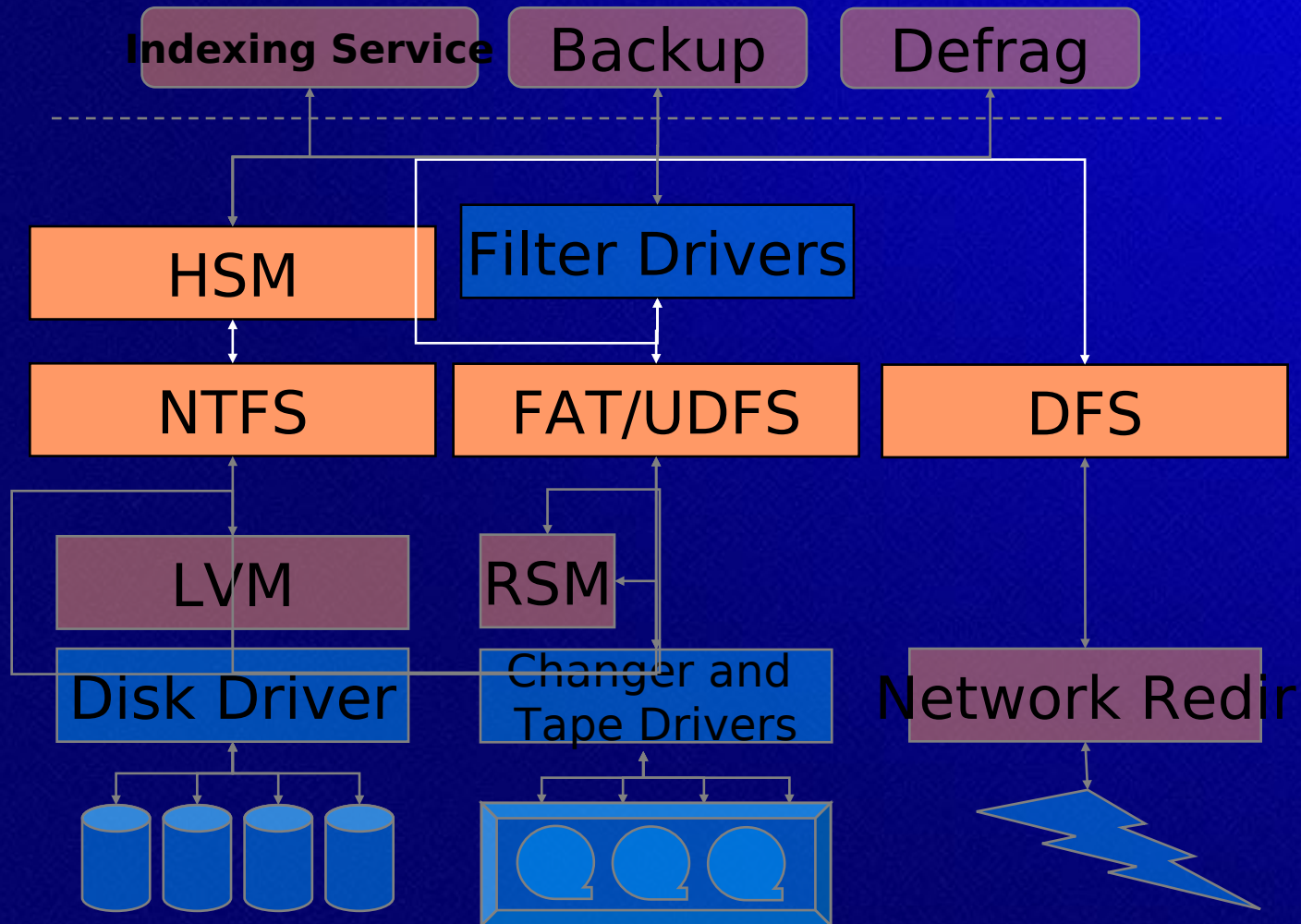


After
RSM



Storage Architecture

File Systems and Filter Drivers



File system changes

Overview

- ◆ **CDFS, FAT are in maintenance mode**
- ◆ **FAT32 filesystem added**
- ◆ **UDF Read support added**
- ◆ **NTFS enhanced in Windows 2000**
 - **Advanced storage features**
 - **Windows 2000 only**

File system changes

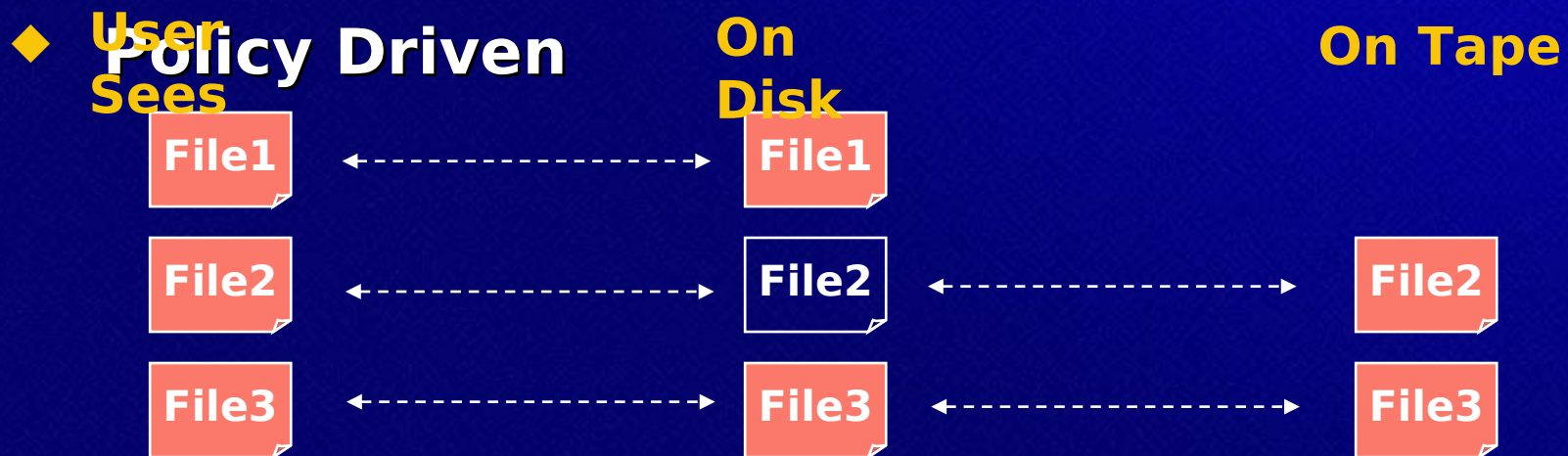
NTFS version 5

- ◆ **Encryption**
- ◆ **Volume mount points**
- ◆ **Disk Quota support**
- ◆ **Change Journal**
- ◆ **Sparse files, Object Ids**
- ◆ **CHKDSK has improved performance**
- ◆ **Native Property Sets**

Hierarchical Storage Management

(HSM)

- Least recently used files are rarely accessed again
- ◆ Least recently files consume majority of disk space
- ◆ HSM automatically migrates and recalls files to most cost effective storage
- ◆ User sees all files regardless of storage

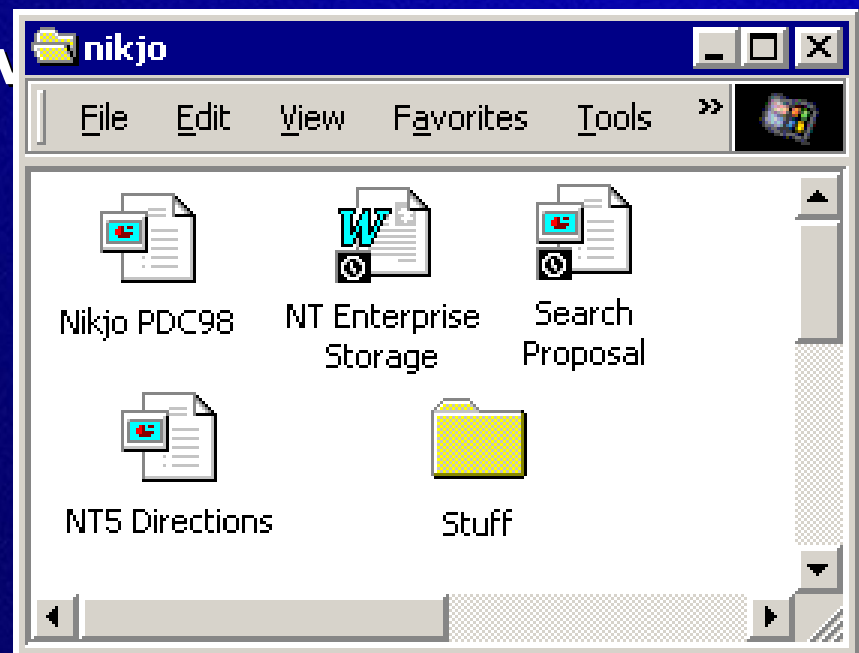


HSM in Windows

2000 RSS = Remote Storage Server,
Ships in Windows® 2000 Server
versions

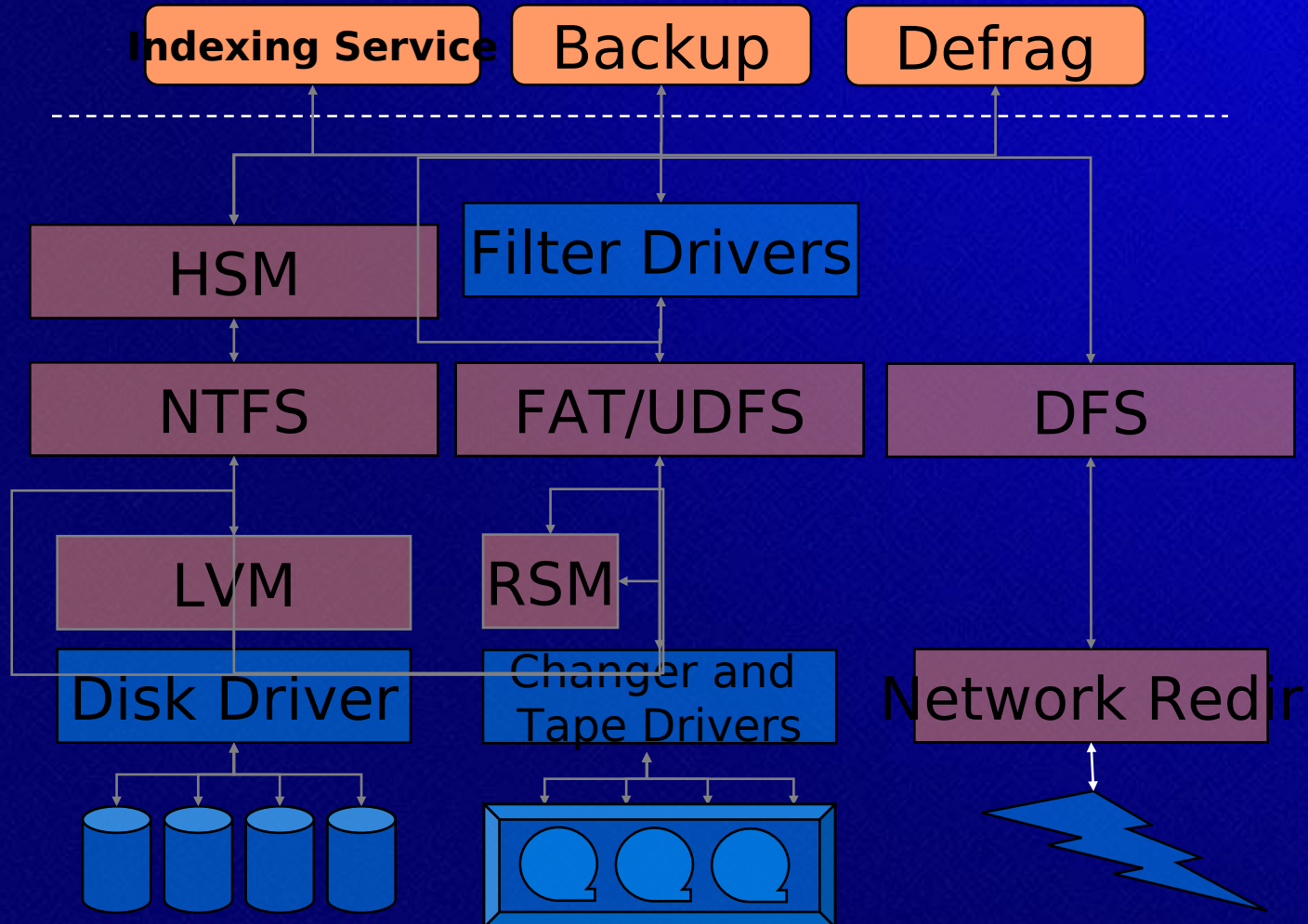
- ◆ Two tiers, supporting tape as second tier

◆ Uses RSM for dev
Shell integration, and
Windows® 2000
system integration
Provided by Seagate
Software.



Storage Architecture

Applications and Services



Microsoft Indexing Service

- ✦ **Provides full text and property search of all supported files on the system using indexes**
 - **Faster, more efficient**
- ◆ **Runs on FAT, FAT32 and NTFS volumes**
- ◆ **Optimized for NTFS v5 (uses journal)**
- ◆ **Fully integrated with Windows 2000 features**
- ◆ **OLE-DB and ADO interface for application developers**
- ◆ **Ships in all Windows 2000 versions**

Backup

- ◆ **Continues to focus on low-end backup**
- ◆ **Usability**
 - **Explorer-like interface, Wizards**
 - **Tabs for functions**
- ◆ **System integration**
 - **Support of all new file system features**
 - **File system agnostic (FAT, FAT32, NTFS)**
 - **Scheduling**
 - **Changers supported via RSM**
 - **Can also backup to a file now**
 - **Full Windows 2000 integration (AD, EFS, ...) via published APIs**

Defrag

- ◆ **Filesystem drivers actually move the bits**
- ◆ **MMC-based GUI**
- ◆ **Operates on all writeable Windows® 2000 file systems**
 - **NTFS, FAT, FAT32**
- ◆ **Provided by Executive Software**

For More Information

- ◆ White papers on www.microsoft.com
- ◆ Check Frequently

DEM

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